



SPECIFICATION

TO ALL WHOM IT MAY CONCERN:

BE IT KNOWN THAT I, TAKURO SEKIYA, a citizen of Japan residing at No.23-38, Mitakedai, Midori-Ku, Yokohama-Shi, Kanagawa-Ken, Japan have invented certain new and useful improvements in

INKJET RECORDING HEAD ADAPTED FOR
IMPROVED PRECISION OF MOUNTING

of which the following is a specification :



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BACKGROUND OF THE INVENTION

Inv C1 > The present invention generally relates to inkjet printers and more particularly to a recording head of such an inkjet printer.

5 Inkjet printers are used extensively for printers of personal computers and other information processing apparatuses.

Conventional inkjet printers have a recording head for ejecting ink toward a recording object in the 10 form of inkjet and an ink reservoir for holding the ink, wherein the ink reservoir is formed separate from the recording head and the ink is supplied to the recording head from the reservoir via an interconnection tube.

Such a construction of the inkjet printer is disclosed 15 for example in the Japanese Laid-open Patent Publication 57-24283. On the other hand, such a construction of the conventional inkjet recording apparatus to use the interconnection tube is complex and increases the size 20 of the recording apparatus. Further, such a construction requires a substantial workload of the user of the printer when replacing the ink reservoir.

On the other hand, another type of inkjet recording apparatus is disclosed in the Japanese Laid-open Patent Publications 3-101954 - 3-101972, wherein 25 the recording head is fixed upon the ink reservoir.

1 Thereby, the recording head and the ink reservoir form
an integral cartridge. By constructing the inkjet
recording apparatus as such, one can eliminate the
interconnection tube between the head and the ink
5 reservoir and the construction of the printer apparatus
is substantially simplified. Further, the overall size
of the recording apparatus is reduced.

10 In the latter integral type inkjet recording
apparatus, the integral cartridge is replaced by a new
one when the ink in the ink reservoir is used up. As
the recording head is much more expensive as compared
with the ink reservoir, such a construction of the
integral cartridge has a drawback of high running cost
although the workload of the user to replace the ink
15 reservoir is substantially reduced.

SUMMARY OF THE INVENTION

Accordingly, it is a general object of the
present invention to provide a novel and useful
20 recording head unit of an inkjet recording apparatus
wherein the foregoing problems are eliminated.

Another and more specific object of the
present invention is to provide a recording head unit of
an inkjet recording apparatus, comprising a recording
25 head part for recording an image on a recording object

1 by forming a jet of ink and an ink reservoir part for
containing the ink wherein the ink reservoir part alone
is replaced when the ink contained therein is used up
with a simple working procedure of the user.

5 Another object of the present invention is to
provide a recording head of an inkjet recording
apparatus for recording an image on an object,
comprising:

10 a recording head unit supplied with ink for
recording an image on a recording object by forming a
jet of the ink, said recording head unit comprising: a
nozzle for ejecting said jet; a passage of ink provided
in communication with said ink nozzle for supplying said
ink to said nozzle; an energization part provided on
15 said passage for applying energy to said ink in said
passage to form said jet; and an ink inlet formed in
communication with said passage for receiving said ink,
said inlet including therein filter means which is made
from stainless steel mesh for eliminating particles from
20 said ink supplied to said inlet; and

an ink reservoir unit for holding therein said
ink, said ink reservoir supplying said ink held therein
to said inlet of said recording head part, said ink
reservoir accommodating therein a material infiltrated
25 with said ink;

1 said recording head unit carrying thereon
first connection means as a part of said recording head
unit, for connecting said recording head unit to said
ink reservoir unit;

5 said ink reservoir unit carrying thereon
second connection means corresponding to said first
connection means as a part of said ink reservoir unit,
for connecting said ink reservoir unit to said recording
head unit;

10 said first and second connection means being
so formed that said first and second connection means
establish, when said ink reservoir unit is mounted upon
said recording head unit, a detachable engagement with
each other in a manner, such that said ink in said
15 reservoir unit flows to said passage in said recording
head unit.

According to the present invention, one can
eliminate the complex interconnection tube between the
ink reservoir and the recording head while allowing
20 continuous use of expensive recording head unit when the
ink held in the ink reservoir unit is used up. By
holding the ink in the state infiltrated in a medium,
one can avoid the formation of bubbles in the ink
reservoir unit even when the recording head is shaken
25 violently.

1 In a preferred embodiment of the present
invention, said recording head further includes a
carriage member adapted to be mounted upon an image
recording apparatus for carrying said recording head
5 unit and said reservoir unit together in the state that
said recording head unit and said reservoir unit are
connected with each other, said carriage member having a
positioning part for determining the position of said
nozzle of said recording head unit with respect to said
10 carriage member. By providing the carriage member, one
can maintain an exact alignment of the recording head
unit with respect to the recording apparatus and hence
to a recording object such as a recording sheet before
and after the replacement of the ink reservoir.

15 In another preferred embodiment of the present
invention, said carriage member includes a base part for
carrying said recording head unit and said ink reservoir
unit and a cover part mounted upon said base part in a
manner rotatable with respect thereto, said positioning
20 part being provided on said base part in the form of a
cutout adapted to the shape of said recording head unit
for holding said recording head unit therein, said cover
part urging said recording head unit resiliently upon
said base part.

25 In another preferred embodiment of the present

1 invention, said cover part carries thereon an
interconnection pattern for carrying electric signals,
said recording head unit thereby establishing an
electrical contact with said interconnection pattern
5 when said recording head unit and said ink reservoir
unit are mounted upon said carriage member.

In another preferred embodiment of the present
invention, said recording head unit has a first guide
part for guiding said ink reservoir unit with respect to
10 said recording head unit along a path for mounting and
dismounting said ink reservoir unit on and from said
recording head unit, said ink reservoir unit having a
corresponding second guide part for engagement with said
first guide part.

15 In another preferred embodiment of the present
invention, said recording head unit has a generally L-
shaped form having a front part and a top part connected
with each other, said ink reservoir unit having a
rectangular shape having a front surface for engagement
20 with said front part of said recording heat unit and a
top surface for engagement with said top part of said
recording head unit, said recording head unit carrying
said first guide part at a lower surface of said top
part while said reservoir part carrying said second
25 guide part at said top surface.

1 In another preferred embodiment of the present
invention, said second connection means of said ink
reservoir unit comprises an opening and a seal membrane
sealing said opening, said first connection means of
5 said recording head unit being provided so as to break
said seal membrane when said ink reservoir unit is
mounted upon said recording head unit.

In another preferred embodiment of the present
invention, said first connection means of said recording
10 head unit comprises a substantially rigid tubular member
for insertion into said ink reservoir part such that
said tubular member breaks said seal membrane when said
ink reservoir unit is mounted upon said recording head
part, said tubular member having a passage of ink
15 therein in communication with said passage of ink in
said recording head unit.

In another preferred embodiment of the present
invention, said tubular member has a sharp pointed part
that breaks said seal membrane when said ink reservoir
20 unit is mounted upon said recording head unit.

In another preferred embodiment of the present
invention, said ink reservoir unit further has a vent
for communicating an interior and an exterior of said
ink reservoir unit, said vent being closed by a
25 removable seal member.

1 In another preferred embodiment of the present
invention, said removable seal member comprises a screw
threaded into a wall of said ink reservoir unit.

5 In another preferred embodiment of the present
invention, said removable seal member comprises a
substantially rigid projection formed unitrarily to a
wall of said ink reservoir unit in correspondence to
said vent for closing said vent, said projection being
so shaped that said vent is formed upon breaking of said
10 projection.

Other objects and further features of the
present invention will become apparent from the
following detailed description when read in conjunction
with the attached drawings.

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BRIEF DESCRIPTION OF THE DRAWINGS

FIG.1 is a diagram showing a recording head
unit according to a first embodiment of the present
invention in a perspective view;

20 FIG.2 is a diagram showing the recording head
unit of FIG.1 in a cross sectional view;

FIG.3 is a diagram showing the recording head
unit of FIG.1 in an exploded view;

25 FIG.4 is a diagram showing a head chip used in
the recording head unit of FIG.1 in a perspective view;

1 FIG.5 is a diagram showing the head chip of
FIG.4 in an exploded view;

FIG.6 is a diagram showing a part of the head
chip of FIG.4 in an enlarged cross sectional view;

5 FIG.7 is a diagram showing the connection of
an ink reservoir to a recording head part in the
recording head unit of FIG.1;

10 FIG.8 is a diagram showing a part of the ink
reservoir used in the recording head unit of FIG.1 in an
enlarged cross sectional view;

FIG.9 is a diagram showing the construction of
a carriage used in an inkjet printer for holding the
recording head unit of FIG.1 with a proper positional
alignment;

15 FIG.10 is a diagram showing the state wherein
the recording head unit is held on the carriage of FIG.9
in a cross sectional view;

20 FIG.11 is a diagram showing a second
embodiment of the present invention in the state before
the ink reservoir is mounted upon the recording head
part in an enlarged cross sectional view;

FIG.12 is a diagram similar to FIG.11 showing
the second embodiment in the state wherein the ink
reservoir is mounted upon the recording head part; and

25 FIGS.13(A) and 13(B) are diagrams showing a

1 third embodiment of the present invention in a cross
sectional view.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

5 FIG.1 shows a recording head 100 according to
a first embodiment of the present invention in a
perspective view, while FIG.2 shows an elevational cross
sectional view of the recording head 100 of FIG.1.
Further, FIG.3 is an exploded view of the recording head
10 100 of FIG.1.

Referring to FIG.1, the recording head 100 is
generally formed of a recording head unit 1
and an ink
reservoir unit 2, wherein the recording head unit 1
includes a base part 3 that carries thereon a flexible
15 printed circuit board (FPCB) 4 and a head chip 5.

FIGS.4 and 5 show the head chip 5. Referring
to FIGS.4 and 5, the head chip 5 is generally formed of
a substrate 6 and an orifice plate 7. The substrate 6
carries thereon a number of energization parts 8 formed
20 by well known photolithographic processes, wherein, as
shown in FIG.5, the energization part 8 includes a
number of resistance patterns 9 acting as a heater, and
each resistance pattern 9 is connected to a control
electrode 10 for receiving a driving signal and a common
25 electrode 11 connected to the ground.

1 FIG.6 shows the cross sectional view of the
head chip 5, wherein it will be noted that the substrate
6, typically formed of silicon, is covered with a
silicon oxide film 12 having a thickness of 1 - 2 μm ,
5 and the silicon oxide film 12 carries thereon a
resistance layer 13 of HfB_2 with a thickness of about
3000 \AA . Typically, the layer 13 is formed by a
sputtering process. The resistance layer 13 is
patterned according to the desired shape of a resistance
10 heater 9 by a known photolithographic process, and a
layer of Al or Al alloy is deposited on the resistance
heater 9 with a thickness of about 1 μm by a sputtering
process. The Al layer thus deposited is patterned
subsequently by a photolithographic process to form the
15 electrodes 10 and 11. Further, the resistance heater 9
and the electrodes 10 and 11 thus formed are covered by
a protective silicon oxide film 14 deposited by a
sputtering process with a thickness of about 1 μm , and
another protective film 15 of Ta is deposited on the
20 silicon oxide layer 14 in correspondence to where the
resistance heater 9 is formed.

25 In the foregoing structure of FIG.6, it should
be noted that the silicon oxide film 12 is provided for
dissipating heat generated by the resistance heater 9 to
the substrate 6 efficiently, while the silicon oxide

1 film 14 is provided to protect the resistance heater 9
or the electrodes 10 and 11 from the corrosion by the
ink. On the other hand, the Ta film 15 protects the
resistance heater 9 from mechanical shock that is caused
5 in response to the formation of cavitation in the ink.
It should be noted that such a shock is caused when the
bubbles, formed on the resistance heater 9 as a result
of the heating, collapse.

On the substrate 6 thus formed, there is
10 provided an ink barrier structure 17, which defines a
passage 16 of ink for guiding the ink to the resistance
heater 9, with a thickness of 20 - 50 μm . Typically, a
dry film photoresist is used for the material of the ink
barrier structure 17, and the passage 16 is formed with
15 a desired shape as a result of photolithographic
patterning process. Further, the substrate 6 is formed
with an opening 18 for introducing the ink into the
passage 16 as indicated in FIG.5, wherein the opening 18
penetrates through the substrate 6 from the lower major
20 surface to the upper major surface. Such an opening 18
may be formed by a laser beam cutting or machining
process.

FIG.6 further shows the construction of the
orifice plate 7 in the cross sectional view.

25 Referring to FIG.6, the orifice plate 7 is

1 provided on the ink barrier structure 17 and may be made
of a nickel plate formed by an electro-forming process
with a thickness of 50 - 150 μm , wherein the orifice
place 7 thus formed is subsequently subjected to a gold
5 plating process. The orifice plate 7 is provided with a
number of nozzles 20 facing the resistance heater 9,
wherein each nozzle 20 may have a diameter of 30 - 50
 μm depending upon the specification of the inkjet
recording apparatus. As indicated in FIGS.4 and 5, the
10 nozzle 20 is arranged on the orifice plate 7 in two rows
in correspondence to two rows of the resistance heaters
9.

When assembling the head chip 5, the orifice
plate 7 is urged firmly upon the ink barrier structure
15 17 while applying heat to the structure 17. Thereby,
the sticky dry film photoresist of the ink barrier
structure 17 holds the orifice plate 7 firmly thereon.

The head chip 5 thus formed as shown in FIG.4
is then mounted upon the base part 3 as indicated in
20 FIGS.1 - 3, and the FPCB 4 is attached upon the base
part 3 in electrical connection to the head chip 5 as
shown in FIG.1 by a wire bonding process. It should be
noted that the FPCB 4 carries thereon a number of
contact pads 21 for electrical connection to the
25 external apparatus for receiving image signals.

1 Next, the ink reservoir unit 2 will be
described with reference to FIGS.2 and 3.

Referring to the drawings, the ink reservoir
unit 2 forms a case that accommodates therein a
5 deformable porous material 22 infiltrated with ink such
as a sponge. The ink reservoir unit 2 is formed so as
to be mounted detachably upon the base part 3 and hence
to the recording head unit 1 to form the unitary
recording head 100, wherein the base part 3 is provided
10 with an ink chamber 19 immediately behind the substrate
6 of the head chip 5 in communication with the opening
18 in the substrate 6. Further, the ink reservoir unit
2 is mounted upon the base part 3 of the recording head
unit 1 such that the reservoir 2 is located immediately
15 behind the ink chamber 19.

The base part 3 is formed with a rigid tubular
member 27 as an integral part of the base part 3 such
that the tubular member 27 projects in the outward
direction as indicated in FIG.7, wherein the tubular
20 member 27 is formed with a passage 28 of ink in
communication with the ink chamber 19 for receiving the
ink from the ink reservoir unit 2. The ink reservoir
unit 2 in turn is provided with a corresponding orifice
25 25 for accepting the tubular member 27 when the
reservoir unit 2 is mounted upon the recording head unit

1 1, and an elastic seal ring 26 is provided on the
orifice 25. The seal ring 26 has a through hole 26a
therein, and the tubular member 27 is inserted into the
reservoir 2 through the inner hole 26a of the ring 26 as
5 indicated in FIG.7 when the ink reservoir unit 2 is
mounted upon the recording head unit 1. The elastic
seal ring 26 thereby provides an effective seal between
the recording head unit 1 and the reservoir 2 for
preventing the leak of the ink flowing from the ink
10 reservoir unit 2 to the recording head unit 1.

In the state of FIG.7, the ink held in the
reservoir 2 is supplied to the ink chamber 19 of the
recording head unit 1 via the passage 28 in the tubular
member 27. In order to achieve a reliable sealing
15 action, the diameter of the inner hole 26a of the ring
26 is formed smaller than the outer diameter of the
tubular member 27 by about 10 - 20 %. Further, there is
provided a filter 29 which is made from stainless steel
mesh for eliminating particles or dusts from entering
20 into the ink chamber 19 of the base part 3 with the flow
of the ink.

In order to mount the ink reservoir unit 2
properly upon the base part 3 of the recording head unit
1 to form the recording head 100, the ink reservoir unit
25 2 is provided with a guide part 23 that projects upward

1 on the top surface of the unit 2 as indicated in the
exploded view of FIG.3. In FIG.3, it will be further
noted that the base part 3 has a front plate and a top
plate for fitting the front and top surfaces of the
5 reservoir 2 respectively, and a depression 24 is
provided on the lower surface of the base part 3 in
correspondence to the projection 23 as a corresponding
guide part as indicated in FIG.2. The guide part 23
forms a guide rail extending from the front surface
10 toward the rear surface on the top surface of the ink
reservoir unit 2, and a corresponding guide groove
forming the guide part 24 extends in the forward
direction from the rear edge of the top plate of the
base part 3.

15 When assembling the ink reservoir unit 2 and
the recording head unit 1 together, the ink reservoir
unit 2 is attached to the base part 3 such that the
front edge of the guide part 23 is accepted by the rear
edge of the guide part 24. Under this state, the ink
20 reservoir unit 2 is pushed forward with respect to the
base part 3 until the tubular member 27 is fully
inserted into the reservoir 2 via the inner hole 26a of
the elastic ring 26. It should be noted that the ink
reservoir unit 2 thus mounted upon the base part 3 of
25 the recording head unit 1 is detachable therefrom by

1 simply pulling it out in the backward direction. Thus,
the user of the inkjet printer can replace the ink
reservoir unit 2 by simply removing an old ink reservoir
unit from the base part 3 and replacing with a new one.
5 It should be noted that the tubular member 27 has a
sufficient rigidity that allows insertion into the ink
reservoir unit 2 against the resistance exerted by the
elastic ring 26.

In the state that the ink reservoir unit 2 is
10 supplied from a vendor, the orifice 25 is sealed by
applying a suitable seal means (not shown in FIG.7) on
the elastic ring 26. This seal is broken when the
reservoir 2 is mounted upon the base part 3. Because of
15 the rigidity of the tubular member 27, the breaking of
the seal is achieved without ^a
problem.

As indicated in FIGS.2 and 3 or in FIG.7, the
ink reservoir unit 2 accommodates therein a flexible
porous material such as a sponge 22 infiltrated with
ink, and a rear cover lid 30 closes the rear opening of
20 the ink reservoir unit 2. The cover lid 30 is provided
with a minute vent 30a for communicating the interior of
the reservoir unit 2 with the surrounding atmosphere for
compensating for the drop of pressure that occurs with
the consumption of the ink in the ink reservoir unit 2,
25 wherein the vent 30a is plugged with a screw member 31

1 or other suitable seal means as indicated in FIG.8 in
the state that the unit 2 is supplied from the vendor.
When using the unit 2 in an inkjet printer, the user
removes the screw member 31.

5 Next, a carriage 32 for carrying the recording
head 100 thus formed in an inkjet recording apparatus
will be described with reference to FIGS.9 and 10.

Referring to FIG.9, the carriage 32 is
provided in an inkjet image recording apparatus
10 schematically illustrated by a reference numeral 150,
wherein the carriage 32 is held on the recording
apparatus 150 in a manner movable in the horizontal
scanning direction as indicated by an arrow. As usual
in the inkjet printers, there is provided a platen
15 roller 151 for holding a recording sheet thereon, and
the recording head 100 carried on the carriage 32
records an image on the recording sheet on the platen
roller 151 in the form of dot pattern formed by the
inkjet as the head 100 is moved back and forth in the
20 horizontal scanning direction.

The carriage 32 includes an L-shaped base
section 33 and an L-shaped cover member 35 held
rotatably upon the lower base section 33 at a hinge 34.
The L-shaped base section 33 has a front member 36a on
25 which a cutout 36 is formed for holding the base part 3

1 of the recording head unit 1, wherein the cutout 36
includes two mutually opposing side edges 36b and a
bottom edge 36c both formed on the foregoing front
member 36a. In the state of FIG.9, the front surface 3a
5 of the ink reservoir unit 2 (see FIG.1) contacts with
the front member 36a of the L-shaped base section 33.

The cutout 36 holds therein the front
projecting part of the base part 3 that carries thereon
the head chip 5 and the ink chamber 19 as indicated in
10 FIG.10. In correspondence to the construction of
FIG.10, it will be noted that the cutout 36 has a shape
corresponding to the shape of the projecting part of the
base part 3 such that the bottom surface 3c of the
projecting part (FIG.1) is supported by the bottom edge
15 36c and both lateral sides 3b (FIG.1) of the projecting
part is supported laterally by the side edges 36b.

The L-shaped cover member 35 includes an upper
part 35a and a rear part 35b connected with each other
and carries thereon contacts 37 at the lower surface of
20 an upper part 35a such that each of the contacts 37
establishes an electrical connection with a
corresponding contact pad 21 formed on the recording
head unit 1. In order to assure a reliable electrical
connection, the cover member 35 is urged in the
25 direction of an arrow a as indicated in FIG.10 by a

1 spring not illustrated.

When replacing the ink reservoir unit 2, the user rotates the member 35 about the hinge 34 in the direction represented by another arrow a' against the urging force of the spring and takes out the recording head 100 from the carriage 32. After this, the ink reservoir unit 2 is pulled out in the backward direction with respect to the recording head unit 1 along the guide members 23 and 24 as already described. Next, a new ink reservoir unit 2 is prepared ready for mounting upon the recording head unit 1 by removing the plug or seal of the orifice 25 and further removing the screw or seal 31. The new ink reservoir 2 thus prepared is mounted upon the recording head unit 1 by engaging the guide members 23 and 24 with each other and pushing the unit 2 in the forward direction with respect to the recording head unit 1 along the guide members 23 and 24, until the tubular member 27 is fully inserted into the orifice 25 via the elastic ring 26.

20 The recording head 100 thus assembled is then returned upon the carriage 32 by rotating the cover member 35 in the direction a'. After fitting the projecting part of the base member 3 in the corresponding positioning cutout 36, the cover member 35 is released and the member 35 rotates in the direction a

1 as a result of the resilient force exerted by the
spring. When the cover member 35 is fully rotated, the
electric connection is established between the contact
pads 21 and the contacts 37.

5 In the recording head 100 of the present
invention, the expensive recording head unit 1 is kept
and continue to be used
using while only the ink reservoir unit 2 is discarded
when the ink is used up. As a result, the running cost
of the image recording apparatus is reduced

10 significantly. Further, such a construction of the
inkjet printer is suitable for saving valuable
resources. Further, it will be noted that the present
invention eliminates the need for the complex and
tedious work of the user to connect the ink reservoir
15 and the recording head part by one or more tubes. The
connection between the ink reservoir unit 2 and the
recording head unit 1 is established automatically by
simply mounting the ink reservoir unit 2 upon the
recording head unit 1. Thereby, it should be noted that
20 the leak of ink at the interconnection part is prevented
by the use of the elastic ring 26 that experiences
elastic deformation when the tubular member 27 of the
recording head unit 1 is inserted into the ink reservoir
unit 2.

25 Further, by providing the filter 29 on the

1 tubular member 27 in correspondence to the tip end part
thereof, one can eliminate the penetration of dusts or
particles from the ink reservoir unit 2 into the ink
chamber 19 and hence into the head chip 5, and the
5 problem of the ink passage 16 or the nozzle 20 of the
head chip 5 being interrupted by the dusts is
eliminated. The vent 30a on the rear lid 30 guarantees
the pressure equilibrium between the interior of the
reservoir unit 2 and the surrounding atmosphere, and the
10 supply of the ink from the reservoir unit 2 to the
liquid chamber 19 of the recording head unit 1 is
maintained even when the amount of ink in the reservoir
unit 2 is reduced. As the interior of the ink reservoir
unit 2 is sealed by the plug or seal member closing the
15 orifice 25 as well as by the screw 31 or seal member
closing the vent 30a in the state when the ink reservoir
unit 2 is shipped by a vendor, the evaporation of the
ink in the ink reservoir unit 2 during transportation or
storage is effectively eliminated.

20 Another major advantage of the present
invention is that the recording head 100 is carried by
the carriage 32 with a precise positional alignment
thereto as a result of the positioning achieved at the
cutout 36 that acts as a positioning means. As the
25 carriage 32 is mounted upon the recording apparatus 150

1 as schematically indicated in FIG.9, the precision of
the image recording remains substantially unchanged even
when the ink reservoir unit 2 is replaced, as the
position of the recording head 100 with respect to the
5 recording apparatus 150 is determined by the engagement
of the recording head unit 1 with the carriage 32 at the
front part of the base part 3 on which the head chip 5
is carried. Further, as the electrical contact of the
recording head 100 is achieved on the recording head
10 unit 1 of which position is exactly determined with
respect to the carriage 32, a reliable, failure-free
electrical connection can be achieved with respect to
the recording head 100. Further, the use of the porous
material 22 in the ink reservoir unit 2 eliminates the
15 problem of cavitation in the ink even when the recording
head 100 is shaken violently. Thereby, the problem of
the bubbles formed in the ink reservoir unit 2 blocking
the ink passage 16 is effectively eliminated, and a
reliable ^{Recording} ~~recoding~~ of images is achieved on a recording
20 sheet.

Next, a second embodiment of the present
invention will be described with reference to FIG.11.
In FIG.11, those parts constructed identically to the
parts described previously are designated by the same
25 reference numerals and the description thereof will be

1 omitted.

Referring to FIG.11, an elastic ring 38 having an inner hole 38a is used in place of the elastic ring 36, wherein the elastic ring 38 has a membrane 39 for sealing the orifice 25. In correspondence to the elastic ring 38 thus configured, the tubular member 27 is formed to have a sharpened tip end 40 such that the sharp tip end 40 breaks the membrane 39 when the reservoir 2 is mounted upon the recording head unit 1 as indicated in FIG.12. In correspondence to the sharpened shape of the tip end 40 of the tubular member 27, the recording head of the present embodiment carries a filter 29' in place of the filter 29 in the interior of the liquid chamber 19 in correspondence to the root part of the tubular member 27. According to the construction of the present embodiment, one can eliminate the use of separate plug or seal member for sealing the hole 38a and hence the orifice 25. Further, such a membrane 39 is easily broken by the sharp tip end 40 of the tubular member 27. The construction of the present invention is particularly beneficial to the user of the inkjet printer, as the user can carry out the replacement of the ink reservoir unit 2 without having the stain of ink on the finger.

25 FIGS.13(A) and 13(B) show a third embodiment

1 of the present invention. In the drawings, those parts
configured identically to the parts described previously
with reference to preceding drawings are designated by
the corresponding reference numerals and the description
5 thereof will be omitted.

In the present embodiment, the ink reservoir
unit 2 is formed of a plastic and an elongate, needle-
like projection 41 is provided on a part thereof as
indicated in FIG.13(A) in correspondence to where the
10 vent 30a is to be formed. When mounting the ink
reservoir unit 2, the projection 41 is broken to form
the vent 30a on the wall of the reservoir 2. It should
be noted that the vent 30a may be provided on a suitable
part of the ink reservoir unit 2. Thus, the part of the
15 ink reservoir unit 2 on which the projection 41 is to be
formed is not limited to the rear cover lid 30. In such
a construction, too, one can effectively avoid the
evaporation of ink in the ink reservoir unit 2 during
the transportation or storage.

20 It should be noted that the present invention
is not limited to the recording head of thermal inkjet
printers as described heretofore with reference to the
embodiments, but is also useful in other types of inkjet
printers such as the Gould type printers described in
25 the United States Patent 3,683,212, of the stem type

1 printers disclosed in the United States Patent
3,746,120, and the Silonics type printers that employs
piezoelement for energizing the ink as disclosed in the
United States Patent 3,946,398.

5 Because the recording head unit used in the
inkjet printers of these various types of non-thermal
inkjet printers are generally more expensive as compared
with the head used in the thermal inkjet printers, one
may have a more distinct effect of cost reduction when
10 the recording head of the present invention is used in
combination with these non-thermal inkjet printers as
compared with the case of the thermal inkjet printers.

Further, the thermal inkjet printer to which
the present invention is applicable is by no means
15 limited to the type described in the embodiments of the
present invention wherein the ink is ejected vertically
to the plane of the substrate of the head chip. For
example, the recording head of the present invention is
applicable also to the inkjet printers of the edge-
20 shooter type that eject the ink droplet generally
parallel to the surface of the heating element.

Further, the present invention is not limited
to the embodiments described heretofore, but various
variations and modifications may be made without
25 departing from the scope of the invention.